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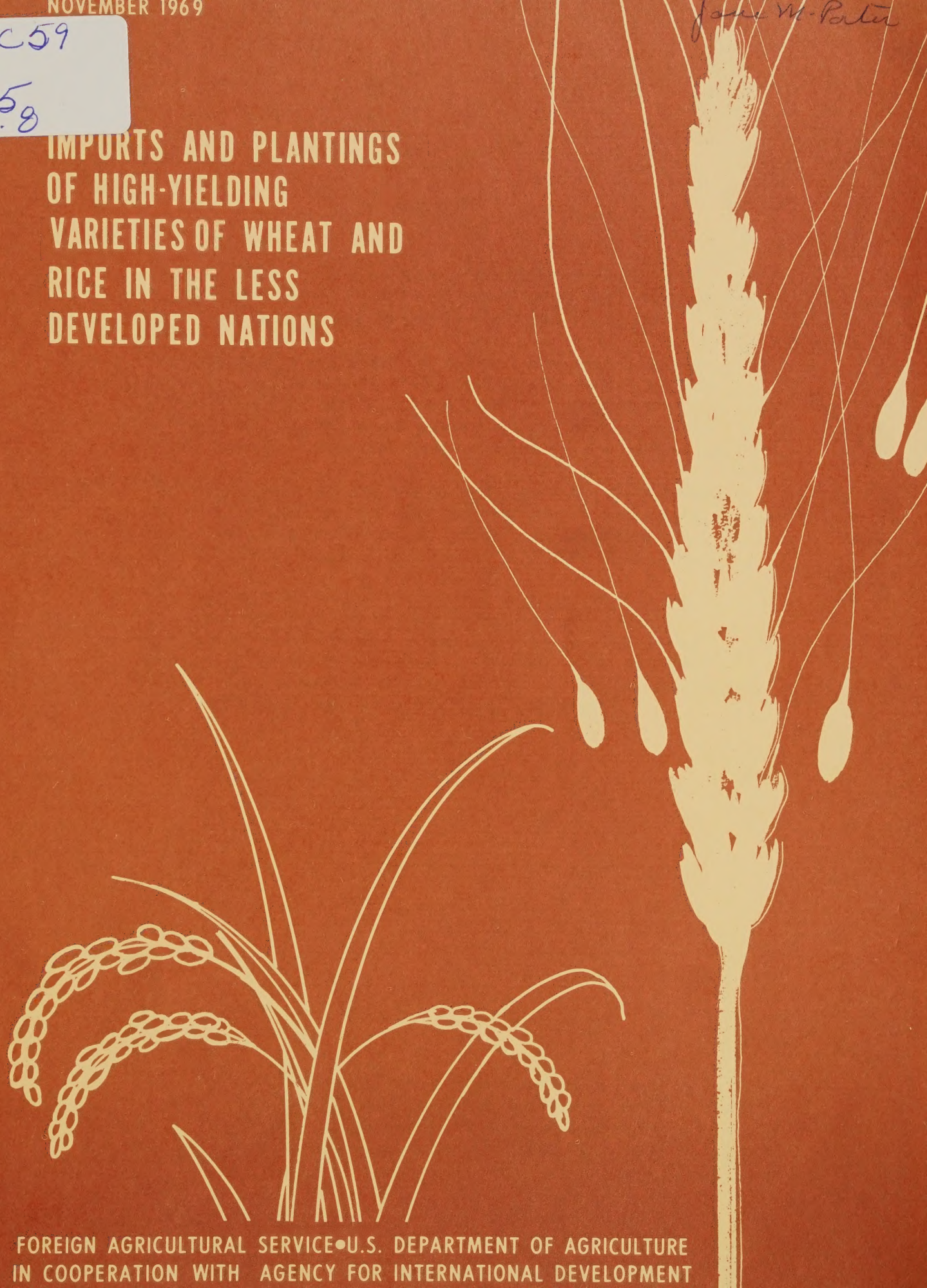


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IMPORTS AND PLANTINGS  
OF HIGH-YIELDING  
VARIETIES OF WHEAT AND  
RICE IN THE LESS  
DEVELOPED NATIONS



FOREIGN AGRICULTURAL SERVICE • U.S. DEPARTMENT OF AGRICULTURE  
IN COOPERATION WITH AGENCY FOR INTERNATIONAL DEVELOPMENT





## PREFACE

This bulletin is an enlarged and updated version of a leaflet with an identical title which was prepared in December 1968 and given limited distribution.

This report is enlarged in that it contains: (a) an expanded introduction, (b) additional countries, (c) more detailed summary tables, and (d) an appendix which outlines the early origin of the high-yielding varieties and indicates area planted to all varieties.

The data represent information in hand as of November 1, 1969. Estimates for the 1968/69 crop year are in some cases preliminary and subject to revision. A few scattered projections for 1969/70 are included.

The revision has benefited from material which was prepared for the AID Spring Review of New Cereal Varieties in May 1969. Many individuals, including AID and USDA field personnel, also provided information. Drs. Randolph Barker of IRRI and Norman Borlaug of CIMMYT have been of continuing assistance.

International Development  
Foreign Agricultural Service  
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IMPORTS AND PLANTINGS OF HIGH-YIELDING VARIETIES OF  
WHEAT AND RICE IN THE LESS DEVELOPED NATIONS

by Dana G. Dalrymple\*

I. INTRODUCTION

The use of new high-yielding varieties of wheat and rice has expanded sharply in the less developed world in recent years. The purpose of this bulletin is to document as completely as possible the quantitative growth in cultivation of these varieties. It reports tonnage of seed imported and area planted or harvested. 1/

The report basically consists of three sets of tables. The first two report imports and area planted by country and crop year for wheat and rice; each is followed by an extensive set of footnotes and references. The third set of tables summarizes the area information.

Definitions

Definition of high-yielding varieties is an inexact process. In this bulletin we will be primarily concerned with dwarf and semi-dwarf varieties developed at the International Wheat and Maize Improvement Center (CIMMYT) in Mexico City, and at the International Rice Research Institute (IRRI) in the Philippines. They are generally known as the Mexican wheats and the IRRI rices (e.g. IR-8). Also included are improved rice varieties developed in (a) India by the Indian Council of Agricultural Research and the Food and Agriculture Organization (FAO), 2/ and (b) the Philippines by various national research programs. 3/ The early origin of these varieties is briefly discussed in Appendix B.

Countries where improved local varieties have been in extensive use for some time are excluded. Mexican wheat acreage has almost entirely been

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1/ For a more analytical discussion of the new varieties, see the various AID Spring Review papers as well as the following U. S. Department of Agriculture publications: Dana G. Dalrymple, Technological Change in Agriculture: Effects and Implications for the Developing Nations, Foreign Agricultural Service, April 1969, pp. 35-51; Joseph W. Willett, The Impact of New Grain Varieties in Asia, Economic Research Service, ERS-Foreign 275, July 1969, 26 pp.

2/ For background on this program see Gove Hambidge, The Story of FAO, Van Nostrand, 1955, pp. 145-148. The leading varieties include ADT-27, which is heavily planted in India, and Mashuri and Malinja, which were further developed in Malaysia. In addition, the Indian figures include Taichung (Native) 1 which originated in Taiwan (see p. 2, fn. 6).

3/ These varieties include: BPI-76, C4-63, and C4-113.



planted to improved varieties for over a decade and is not counted. 4/ Similarly, wheats developed under the auspices of the Rockefeller Foundation in various South American nations beginning in the 1950's are excluded. 5/ Locally developed varieties of rice in use in Taiwan 6/ and Ceylon 7/ are also not included.

In the future it will be increasingly difficult to define varieties on the basis of their origin. Many nations now have intensive wheat and rice breeding programs. In most cases these are based on stock which originally came from the international programs, but this link may become increasingly obscure, except to plant breeders. Also, with subsequent multiplication on farms, high-yielding seeds may become mixed with local varieties.

#### The Data

The data on imports and area generally come from different sources. Most are unpublished. No information is available for Communist Asia. 8/ The seed figures are based on information from both the exporting and importing countries. They are believed to be relatively accurate. Virtually all of the statistics on Philippine exports of rice were provided by

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4/ The proportion of wheat area planted to high-yielding varieties in Mexico went over 90% in 1957. From 1960 to 1965 the improved wheat area averaged from 1.8 to 1.9 million acres. Similar data are not available for the subsequent period, but total wheat area dropped off to an average of 1.74 million acres from 1966 to 1968. (Dana G. Dalrymple, New Cereal Varieties: Wheat and Corn in Mexico, Spring Review, Agency for International Development, July 1969, 32 pp.)

5/ Background on this work, as well as that in Mexico, is provided by E. C. Stakman, Richard Bradfield and P. C. Mangelsdorf in Campaigns Against Hunger, Belknap Press of Harvard University Press, 1967, pp. 216-272.

6/ The Japanese initiated rice breeding work in Taiwan early in the century (S. C. Hsieh and V. W. Ruttan, "Environmental, Technological and Institutional Factors in the Growth of Rice Production: Philippines, Thailand, and Taiwan," Food Research Institute Studies, 1967 (no. 3), pp. 331-333).

7/ The leading local variety is H-4, which was developed in the early 1950's. There are now several H-series varieties. (See N. Bandaranaike, "Ceylon," Regional Seminar on Agriculture: Papers and Proceedings, Asian Development Bank, Manila, 1969, p. 134.)

8/ There is, however, reason for thinking that new varieties are being used: see "Chinese Report New Rice Strain," New York Times, October 26, 1969, p. 21. The historical role of improved varieties is discussed by Dwight H. Perkins in Agricultural Development in China, 1368-1968, Aldine, 1969, pp. 37-53.



Dr. Randolph Barker of IRRI. In a few cases, the import figure represents an authorization rather than an actual shipment; such figures are placed in parentheses. 9/

The area information is largely based on reports submitted by AID country missions or U. S. agricultural attaches. These data, in turn, were often obtained from official reports or estimates by the countries themselves. There is no way of knowing how accurate these sources are. The area figures thus are subject to an unknown degree of error and should be regarded as only approximate. The scattered figures for 1969/70 represent goals and are placed in parentheses.

In addition to the countries reported as importing or planting new varieties, many others have them under test. And some of these nations may have moved into commercial production.

### The Tables

Data are reported separately for wheat and rice. Each of the first two tables contain data on imports and area for individual countries over recent years. A July to June crop year generally is utilized.

Imports are for planting in the crop year specified. In some cases, however, export data are given only by calendar year (or a portion thereof); such figures are assigned to the subsequent crop year. There could well be some errors in this process, so the calendar year involved is footnoted. Shipments to former developing nations such as Israel are not included. 10/

As the title of this bulletin suggests, the acreage figures generally represent planted area. In a few cases, however, harvested area is reported.

For each import and area figure, a footnote is usually provided and a reference is always included. They are listed on the pages following the table. The footnote usually includes information on varietal breakdown. The footnotes are listed first and are indicated by 1/; the references are marked by brackets ( ). Those who intend to cite country figures are strongly urged to refer to both.

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9/ This applies where a nation has requested seed from India or Pakistan (countries receiving PL 480 grain generally are not allowed to export same or like commodities without prior authorization by the U. S. government).

10/ In the case of rice, only shipments of 0.1 metric ton or more are included. Where the seed was purchased directly from IRRI, this is so indicated in the footnotes; otherwise, seed was purchased from commercial sources in the Philippines.

## II. HIGH-YIELDING VARIETIES OF WHEAT

<u>Country and Crop Year</u>	<u>Quantity of Mexican- Type Seed Imported</u>		<u>Area of Mexican-Type Wheat Planted or Harvested</u>	
	<u>- metric tons -</u>		<u>- acres -</u>	
<u>SOUTH ASIA</u>				
<u>Afghanistan</u>				
1965/66	50	<u>1/</u> (1)		
1966/67	420	<u>2/</u> (2) (3)	4,500	<u>3/</u> (4)
1967/68			65,000	<u>     </u> (3)
1968/69			300,000	<u>4/</u> (5)
<u>India</u>				
1965/66	250	<u>1/</u> (1) (2)	7,400	<u>     </u> (3)
1966/67	18,000	<u>2/</u> (1) (2)	1,278,000	<u>3/</u> (1)
1967/68			7,269,000	<u>4/</u> (1)
1968/69			10,000,000	<u>5/</u> (4)
1969/70			(10,000,000)	<u>6/</u> (4)
<u>Nepal</u>				
1965/66			3,500	<u>3/</u> (1)
1966/67	37.5	<u>1/</u> (1)	16,200	<u>4/</u> (1)
1967/68	450	<u>2/</u> (1)	61,300	<u>5/</u> (1)
1968/69			133,000	<u>6/</u> (2)
<u>Pakistan, East</u>				
1968/69			20,000	<u>1/</u> (1)
<u>Pakistan, West</u>				
1965/66	350	<u>1/</u> (1) (2)	12,000	<u>     </u> (1)
1966/67	50	<u>2/</u> (1) (2)	250,000	<u>4/</u> (1)
1967/68	42,000	<u>3/</u> (1) (2)	2,365,000	<u>     </u> (4)
1968/69			6,000,000	<u>5/</u> (5)
<u>EAST ASIA</u>				
<u>Burma</u>				
1968/69	(2)	<u>1/</u> (1)		
1969/70	(300)	<u>2/</u> (2)		
<u>WEST ASIA</u>				
<u>Iran</u>				
1968/69	1,500	<u>1/</u> (1)	25,000	<u>1/</u> (2)
<u>Iraq</u>				
1968/69	(800)	<u>1/</u> (1)		



<u>Country and Crop Year</u>	<u>Quantity of Mexican- Type Seed Imported</u>	<u>Area of Mexican-Type Wheat Planted or Harvested</u>
	- metric tons -	- acres -
<u>WEST ASIA (cont'd)</u>		
<u>Lebanon</u>		
1968/69		1,120 $\frac{1}{2}$ (1)
1969/70		(10,000) $\frac{1}{2}$ (1)
<u>Saudi Arabia</u>		
1969/70	(200) $\frac{1}{2}$ (1)	
<u>Syria</u>		
1969/70	(200) $\frac{1}{2}$ (1)	
<u>Turkey</u>		
1966/67	60 $\frac{1}{2}$ (1)	1,500 (3)
1967/68	22,100 $\frac{2}{2}$ (2)	420,000 (2)
1968/69		1,780,000 (4)
<u>AFRICA</u>		
<u>Algeria</u>		
1969/70	(10) $\frac{1}{2}$ (1)	
<u>Egypt (UAR)</u>		
1969/70	(15) $\frac{1}{2}$ (1)	
<u>Morocco</u>		
1967/68	1 $\frac{1}{2}$ (1)	500 (2)
1968/69	500 $\frac{2}{2}$ (3) (4)	12,100 $\frac{3}{2}$ (3)
1969/70		(250,000) (4)
<u>Sudan</u>		
1969/70	(5) $\frac{1}{2}$ (1)	
<u>Tanzania</u>		
1969/70	(3) $\frac{1}{2}$ (1)	
<u>Tunisia</u>		
1967/68	50 (1)	2,000 $\frac{1}{2}$ (2)
1968/69		32,000 $\frac{2}{2}$ (2)
1969/70		(150,000) (3)
<u>Zambia</u>		
1969/70	(0.2) (1)	
<u>LATIN AMERICA</u>		
<u>Bolivia</u>		
1968/69	50	

FOOTNOTES

SOUTH ASIA

Afghanistan

- 1/ Lerma Rojo 64A. Imported from Mexico in 1965.
- 2/ Lerma Rojo 64: 250 tons from Mexico (ref. 2), and 170 tons from Pakistan (ref. 3).
- 3/ Of this total, nearly 2,000 acres was Lerma Rojo 64A and 1,900 Tascosa.
- 4/ Rough estimate; actual area far from certain. The AID mission is attempting to obtain more exact figures (ref. 6).

India

- 1/ 200 tons of Sonora 64 and 50 tons of Lerma Rojo 64.
- 2/ Mostly Lerma Rojo 64; remainder Sonora 64.
- 3/ Another estimate is considerably lower: 700,000 acres (ref. 5).
- 4/ Another source indicates 7.0 to 7.5 million acres, of which 5.0 to 5.5 million acres represented Mexican varieties and 2 million K-68 (an "outstanding" local variety grown mainly in Uttar Pradesh) (ref. 6).
- 5/ "Estimated achievement." Other estimates run up to 11 million (ref. 7).
- 6/ Target.

Nepal

- 1/ Lerma Rojo. Imported from Mexico by India.
- 2/ Lerma Rojo. From India.
- 3/ Lerma 52.
- 4/ 14,800 acres of Lerma 52; 1,400 of Lerma Rojo.
- 5/ 31,600 acres of Lerma 52; 29,700 of Lerma Rojo.
- 6/ All improved wheat planted; mainly Mexican varieties. Estimate; exact area not certain.

Pakistan, East

- 1/ Unofficial estimate.



FOOTNOTES (cont'd)

SOUTH ASIA (cont'd)

Pakistan, West

- 1/ 250 tons of Penjamo 62 and 100 tons of Lerma Rojo 64.
- 2/ Mostly Mexipak 65 (white) (Siete Cerros); some Mexipak Red (Indus 66). In addition, 20 tons were available locally.
- 3/ 40,000 tons of Mexipak Red (Indus 66) and 2,000 tons of Mexipak 65 (Siete Cerros).
- 4/ Another estimate is considerably higher: 600,000 acres (ref. 6).
- 5/ Other estimates range from 4.5 - 5.0 (ref. 7) to 6.5 million acres (ref. 8). About 80% Mexipak 65 and 10% Indus 66 (ref. 8).

EAST ASIA

Burma

- 1/ Authorization for West Pakistan to ship export Mexipak (white) seed to Burma.
- 2/ Requested authorization for West Pakistan to ship Mexipak seed to Burma.

WEST ASIA

Iran

- 1/ Penjamo 62 imported from Turkey.
- 2/ "About 10,000 hectares;" Penjamo 62.

Iraq

- 1/ Authorization for West Pakistan to export up to 800 tons of Mexipak seed to Iraq.

Lebanon

- 1/ Mexipak.
- 2/ "Minimum" estimate; based on seed available.

Saudi Arabia and Syria

- 1/ Authorization for West Pakistan to export 200 tons of Mexipak seed to each country.

FOOTNOTES (cont'd)

WEST ASIA (cont'd)

Turkey

- 1/ Sonora 64.
- 2/ Only 17,000 tons planted in fall; remainder planted in spring 1968. Included: 6,190 tons of Lerma Rojo 64; 6,950 of Penjamo 62; and 5,860 of Super X.

AFRICA

Algeria and Egypt (UAR)

- 1/ Requested authorization for West Pakistan to export 10 tons of Mexipak seed to Algeria and 15 tons to Egypt (UAR).

Morocco

- 1/ Siete Cerros (plus 150 kg. of Super X).
- 2/ Included 250 tons of Siete Cerros, 100 of Inia 66, 100 of Tobari 66, 25 of Penjamo 62, and 25 of Norteno.
- 3/ 50% Siete Cerros; rest Inia 66, Tobari 66, and Penjamo 62 (ref. 5).

Sudan

- 1/ Authorization for West Pakistan to export 5 tons of Mexipak seed to Sudan.

Tanzania

- 1/ Requested authorization for West Pakistan to ship about 3 tons of Mexipak seed to Tanzania.

Tunisia

- 1/ "Nearly 2,000 acres."
- 2/ 35% Inia 66, 35% Tobari 66, 15% Jaral, and 15% Sonora 63 (ref. 3).

Zambia

- 1/ Requested authorization for West Pakistan to export 412 lbs. of Mexipak to Zambia.

LATIN AMERICA

Bolivia

- 1/ 25 tons of each of two varieties. (Type not stated, but Jaral 66 and Norteno 67 previously tested.)



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SOUTH ASIA

Afghanistan

- (1) "The Green Revolution," Participant Report, USAID, Kabul, Summer 1969, p. 2.
- (2) Fourth Annual Wheat Seminar, August 28, 1969 - September 8, 1969, Ministry of Agriculture and Irrigation, Kabul, summary, paper by Joe Motheral.
- (3) CIMMYT Report, 1967-68, International Maize and Wheat Improvement Center (CIMMYT), Mexico City, pp. 59, 72.
- (4) Agricultural Development in Afghanistan, with Special Emphasis on Wheat, U. S. Agricultural Review Team, July 1967, pp. 31-32.
- (5) Letter from Norman Borlaug, CIMMYT, June 12, 1969; conversation with Dr. Borlaug, October 24, 1969.
- (6) Department of State Telegram 5283 from Kabul, October 20, 1969.

India

- (1) "Rice and Wheat in India," Spring Review (AID), March 10, 1969, p. 7.
- (2) Five Years of Research on Dwarf Wheat, Indian Agricultural Research Institute, New Delhi, 1968, Preface; Grant Cannon, "On the Eve of Abundance," Farm Quarterly, Fall Forecast, 1967, pp. 89-90.
- (3) 1966/67 CIMMYT Report, p. 67.
- (4) Foreign Agricultural Service Report IN-9180 from New Delhi, September 18, 1969, p. 3 (based on "Government of India, Planning Commission, Annual Plan, 1969-70," p. 41).
- (5) CIMMYT Report, 1967-68, p. 59.
- (6) J. H. Boulware and V. M. Tandon, "India Harvests Record Wheat Crop," Foreign Agriculture, May 6, 1968, p. 3.
- (7) CIMMYT Report, 1968-69, p. 57.

Nepal

- (1) Department of State Airgram TOAID A-404 from Kathmandu, February 16, 1968.

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SOUTH ASIA (cont'd)

Nepal (cont'd)

- (2) Letter from Dale G. Strong, Food and Agriculture Division, AID, Kathmandu, September 12, 1969 (data from Agriculture Extension Department of Nepalese Government).

Pakistan, East

- (1) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969.

Pakistan, West

- (1) "Rice and Wheat in Pakistan," Spring Review (AID), March 17, 1969, pp. 3-5.
- (2) 1966-67 CIMMYT Report, pp. 64-65; Cannon, op. cit., p. 90.
- (3) "Annual Technical Report: Accelerated Wheat Improvement Program, West Pakistan, 1966-67," Government of West Pakistan (Agriculture Department, The Planning Cell), Lahore, July 1967, p. 11.
- (4) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1.
- (5) Letter from Leon F. Hesser, Assistant Director of Agricultural Policy, AID, Rawalpindi, October 9, 1969.
- (6) CIMMYT Report, 1967-68, p. 59.
- (7) Telegram TOFAS 96, op. cit.
- (8) CIMMYT Report, 1968-69, pp. 57, 71.

EAST ASIA

Burma

- (1) Department of State Telegram 254765 to Rawalpindi, October 14, 1968.
- (2) Department of State Telegram 5231 from Rawalpindi, May 26, 1969. (Reply in Telegram 87624 to Rawalpindi, May 29, 1969.)



REFERENCES (cont'd)

WEST ASIA

Iran

- (1) Foreign Agricultural Service Reports from Tehran: IR-9003, January 20, 1969; IR-9006, February 5, 1969.
- (2) Foreign Agricultural Service Telegram TOFAS 60 from Tehran, October 25, 1969.

Iraq

- (1) Department of State Telegram 238425 to Rawalpindi, September 13, 1968.

Lebanon

- (1) Foreign Agricultural Service Telegram TOFAS 42 from Beirut, October 10, 1969.

Saudi Arabia and Syria

- (1) Department of State Telegram 9697 from Rawalpindi, October 8, 1969. (Reply in Telegram 172425 to Rawalpindi, October 10, 1969.)

Turkey

- (1) 1966-67 CIMMYT Report, p. 69; Joseph R. Williams, "Wheat Program Leads Off Turkey's New 5-Year Plan," Foreign Agriculture, November 20, 1967, p. 5.
- (2) "Wheat in Turkey," Spring Review (Airgram TOAID A-141 from Ankara, March 21, 1969), pp. 5-6, 12-13. (Also see L. M. Humphrey, Mexican Wheat Comes to Turkey, USAID, Food and Agriculture Division, Ankara, April 1969.)
- (3) CIMMYT Report, 1967-68, p. 59.
- (4) Department of State Telegram 5105 from Ankara, July 29, 1969.

AFRICA

Algeria

- (1) Department of State Telegram 6541 from Rawalpindi, July 3, 1969. (Reply in Telegram 112656 to Rawalpindi, July 17, 1969.)

Egypt (UAR)

- (1) Department of State Telegram 10397 from Rawalpindi, October 29, 1969.

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AFRICA (cont'd)

Morocco

- (1) Department of State Airgram A-272 from Rabat, December 26, 1967.
- (2) CIMMYT Report, 1967-68, p. 73.
- (3) "Morocco: Wheat," Spring Review (AID), March 13, 1969, pp. 2, 4.
- (4) "Moroccan Agriculture Thrives on High-Yield Mexican Wheat," Front Lines (AID), February 15, 1969, p. 3.
- (5) CIMMYT Report, 1968-69, pp. 57, 97.

Sudan

- (1) Department of State Telegram 78540 to Rawalpindi, May 16, 1969.

Tanzania

- (1) Foreign Agricultural Service Telegram TOFAS 23 from Rawalpindi, April 4, 1969. (Reply in Department of State Telegram 56395, April 12, 1969.)

Tunisia

- (1) "Tunisia to Close 'Wheat Gap,'" Front Lines (AID), December 15, 1968, p. 7.
- (2) Foreign Agricultural Service Report TN-9004 from Rabat, June 26, 1969.
- (3) CIMMYT Report, 1968-69, p. 90.

Zambia

- (1) Department of State Telegram 6224 from Rawalpindi, June 26, 1969. (Reply in Telegram 107039 to Rawalpindi, June 28, 1969.)

LATIN AMERICA

Bolivia

- (1) Department of State Telegram 5196 from La Paz, June 21, 1968; Airgram A-802 from La Paz, July 3, 1968.



### III. HIGH-YIELDING VARIETIES OF RICE

Country and Crop Year	Quantity of IRRI Seed Imported			Area of IRRI-Type Rice Planted or Harvested		
	- metric tons -			- acres -		
<u>SOUTH ASIA</u>						
<u>Ceylon</u>						
1967/68	0.5	<u>1/</u>	(1)			
1968/69	210	<u>2/</u>	(1)	17,240	<u>3/</u>	(2)
<u>India</u>						
1964/65	1	<u>1/</u>	(1)	200	<u>3/</u>	(3)
1965/66				13,000	<u>4/</u>	(1) (3)
1966/67				2,142,000	<u>5/</u>	(4)
1967/68	10	<u>2/</u>	(2)	4,409,000	<u>6/</u>	(4)
1968/69				6,500,000	<u>7/</u>	(5)
1969/70				(8,000,000)	<u>8/</u>	(5)
<u>Nepal</u>						
1968/69				105,000	<u>2/</u>	(2)
1969/70	(60)	<u>1/</u>	(1)			
<u>Pakistan, East</u>						
1966/67	10		(1)	500	<u>2/</u>	(2)
1967/68	1,500	<u>1/</u>	(1) (2)	166,000	<u>2/</u>	(3)
1968/69				381,500	<u>2/</u>	(4)
<u>Pakistan, West</u>						
1966/67	2	<u>1/</u>	(1)	200±	<u>3/</u>	(2)
1967/68	77	<u>2/</u>	(1)	10,000	<u>1/</u>	(2)
1968/69				761,000	<u>4/</u>	(2) (3)
1969/70				(1,500,000)	<u>5/</u>	(2)
<u>EAST ASIA</u>						
<u>Burma</u>						
1966/67	0.1	<u>1/</u>	(1)	19	<u>4/</u>	(3)
1967/68	200	<u>2/</u>	(1)	7,200	<u>4/</u>	(3)
1968/69				470,250	<u>5/</u>	(3)
1969/70	200	<u>3/</u>	(2)	(1,000,000)	<u>6/</u>	(4)
<u>Indonesia</u>						
1966/67	0.1	<u>1/</u>	(1)			
1968/69	1	<u>2/</u>	(2)	416,500	<u>3/</u>	(1)

<u>Country and Crop Year</u>	<u>Quantity of IRRI Seed Imported</u>	<u>Area of IRRI-Type Rice Planted or Harvested</u>
	- metric tons -	- acres -
<u>EAST ASIA (cont'd)</u>		
<u>Laos</u>		
1966/67	0.1 <u>1/</u> (1)	900 <u>3/</u> (2)
1967/68		2,500 <u>4/</u> (3)
1968/69	4 <u>2/</u> (1)	3,750 <u>5/</u> (3)
<u>Malaysia (West)</u>		
1967	3 <u>1/</u> (1)	104,450 <u>3/</u> <u>4/</u> (2)
1968	3 <u>2/</u> (1)	156,950 <u>3/</u> <u>5/</u> (2)
1969		224,650 <u>3/</u> <u>6/</u> (2)
<u>Philippines</u>		
1966/67	55.3 <u>1/</u> (1)	204,100 (2)
1967/68	6.1 <u>2/</u> (1)	1,733,400 <u>4/</u> (3)
1969/70	18.2 <u>3/</u> (1)	2,500,000+ <u>5/</u> (4)
<u>Vietnam</u>		
1967/68	45 <u>1/</u> (1)	1,200 <u>3/</u> (1)
1968/69	2,005 <u>2/</u> (2)	109,000 <u>4/</u> (1)
1969/70		(494,000) <u>5/</u> (1)
<u>WEST ASIA</u>		
<u>Iraq</u>		
1969	(100) <u>1/</u> (1)	
<u>AFRICA</u>		
<u>Egypt (UAR)</u>		
1968/69	100 <u>1/</u> (1)	
<u>Ghana</u>		
1968/69	2 <u>1/</u> (1)	
<u>Liberia</u>		
1968/69	3 <u>1/</u> (1)	
<u>LATIN AMERICA</u>		
<u>Panama</u>		
1967	10 <u>1/</u> (1)	
<u>Venezuela</u>		
1968	10 <u>1/</u> (1)	

FOOTNOTES

SOUTH ASIA

Ceylon

- 1/ IR-8 (from IRRI).
- 2/ IR-8. Exported from Philippines in 1968.
- 3/ IR-8. Of the total, 1,131 acres were planted in Yala 1968 and 16,107 in Maha 1968/69. (Excludes 15,500 acres of a variety known as A-8; in addition, slightly over 1 million acres of the locally developed H-series of rices were planted.)

India

- 1/ Tachung (Native) 1. Hereinafter noted as TN-1. Developed in Taiwan and provided in 1965 before IR-8 and IR-5 were ready.
- 2/ IR-8 (from IRRI).
- 3/ ADT-27. Developed by the Indian Council of Agricultural Research and FAO (under the auspices of the International Rice Commission).
- 4/ Composed of 2,500 acres of ADT-27 and 11,150 acres of TN-1 (150 from Kharif or summer season, and 10,000 from Rabi or winter season).
- 5/ Kharif season; in addition, some improved varieties were planted during the Rabi season.
- 6/ Kharif season.
- 7/ "Estimated Achievement." Other references indicate both lower and higher total figures -- ranging from 5.7 to 7.2 million acres (and with the following varietal areas: IR-8, 3 to 4 million; TN-1, 1.5 to 2 million). Two new varieties, Jaya and Padma, were released; they were developed by the All-India Coordinated Rice Improvement Project in cooperation with a team of specialists from IRRI under contract with AID.
- 8/ Target.

Nepal

- 1/ Authorization for India to export "paddy seeds" (presumably IR-8) to Nepal.
- 2/ All improved rice; mainly IR-8 and TN-1. Estimate; exact area not certain.



FOOTNOTES (cont'd)

SOUTH ASIA (cont'd)

Pakistan, East

- 1/ IR-8. Philippine data (ref. 5) indicate that 3,600 tons of IR-8 were shipped to Pakistan in 1967. The reason for the difference between this figure and total Pakistan imports cited here (1,500 in the East and 50 in the West) has not been determined.
- 2/ Primarily IR-8; some IR-5.

Pakistan, West

- 1/ IR-8.
- 2/ IR-8. 50 tons were imported directly from Los Banos. Another 27 tons were forwarded from East Pakistan where they were produced during the 1966/67 season. See East Pakistan fn. 1.
- 3/ "Few hundred acres."
- 4/ Includes a "few thousand" acres of IR-6 in the Hyderabad region; this variety is expected to eventually replace IR-8 (ref. 4).
- 5/ Target.

EAST ASIA

Burma

- 1/ IR-8. Imported from IRRI in 1966.
- 2/ IR-8. Imported from Philippines in 1967.
- 3/ IR-5. Imported from Philippines in first half of 1969.
- 4/ IR-8.
- 5/ IR-8. In addition, 60 acres of Ngwetoe, an improved local variety, were planted.
- 6/ Target for IR-8. In addition, IR-5 (known locally as Yagyaw-2) is to be planted on 12,700 acres and Ngwetoe on 5,000 acres.

FOOTNOTES (cont'd)

EAST ASIA (cont'd)

Indonesia

- 1/ 200 kg.; introduced from IRRI in 1966. "There have been additional imports of small lots of seed but they have probably not exceeded one metric ton" (ref. 1).
- 2/ C-63; developed at the College of Agriculture at the University of the Philippines; imported in 1968.
- 3/ IR-8, IR-5; known locally as PB-8 and PB-5. Nearly 43,000 acres in 1968 dry season and 374,000 in 1968/69 wet season. Of the wet season total, the area was divided as follows between programs: Bimas Baru, 182,000; Imnas Baru, 51,000; Bimas Baru Gotong Rojong, 141,000. "Only in the 1968/69 wet season did the IRRI varieties, after two years of trials and seed production efforts, begin to be widely used" (ref. 3).

Laos

- 1/ IR-8. Imported from IRRI in 1966.
- 2/ 2 tons of IR-5; 2 tons of IR-253 (not yet an official variety). Imported from Philippines in 1968.
- 3/ "Non-photosensitive varieties." Dry season.
- 4/ IR-8; dry season. 500 acres of IR-8 were also planted during the 1968 wet season but did not do well (ref. 4).
- 5/ IR-8, IR-5, IR-242, IR-253; dry season. About 2,000 acres of the latter two varieties were also planted during the wet season of 1969 (ref. 4). "At the present, IR-253 (glutinous) and C-463 (non-glutinous) show the greatest promise for Laos" (ref. 5).

Malaysia (West)

- 1/ IR-8. Imported from IRRI in 1966.
- 2/ IR-8. Imported from IRRI in 1967.
- 3/ Includes a number of improved hybrids. About 90% is Mahsuri, a cross between Taichung 65 and Mayang Ebos 80, which was introduced in January 1965. The remaining 10% is divided between (a) Malinja, a cross between Siam 29 and Pebifun, which was introduced in early 1950's, and (b) Ria, a local name for IR-8, which was introduced in late 1966. (Refs. 2 and 3.) Both Mahsuri and Malinja have their early origins in the same FAO-India program which produced ADT-27.

FOOTNOTES (cont'd)

EAST ASIA (cont'd)

Malaysia (West) (cont'd)

- 4/ IR-8 area estimated to be 6,000 acres.
- 5/ IR-8 area estimated to be 8,000 acres.
- 6/ IR-8 area estimated at 3,000 acres. With the introduction of Bahagia, which originated from the same varietal cross as IR-5, in September 1968, Ria and Malinja are expected to decrease in use.

Philippines

- 1/ Purchased from IRRI in July 1966 and planted in dry season in late 1966 and early 1967.
- 2/ 5.2 tons IR-8 and 0.9 tons IR-5 (from IRRI).
- 3/ 0.1 tons IR-8 and 18.1 tons IR-5 (from IRRI).
- 4/ Harvested area: the total was broken down as follows: IR-8, 1,059,000 acres; BPI-76, 629,000; others, 45,000. For all three categories, 643,000 acres were in program areas and 1,090,000 in non-program areas. Another estimate indicates a total of 871,000 acres for Priority Areas 1-III (ref. 2). BPI-76 was developed by the Bureau of Plant Industry of the Philippine Government.
- 5/ Unofficial preliminary estimate of "over 1 million hectares." About 2/3 IR-8 & IR-5 and 1/3 BPI & C series.

Vietnam

- 1/ IR-8.
- 2/ 2,000 tons of IR-8, 5 tons of IR-5. Another source indicates that the Philippines exported 1,807 tons of IR-8 and 205 tons of IR-5 to Vietnam (ref. 1). The reason for the difference in varietal composition is not known at this point.
- 3/ Area planted. Only about 330 acres were harvested because of poor rains.
- 4/ Area planted.
- 5/ Target.



FOOTNOTES (cont'd)

WEST ASIA

Iraq

1/ IR-8. Imported from Philippines during the first half of 1969.

AFRICA

Egypt (UAR)

1/ IR-8. Imported from Philippines in 1967.

Ghana

1/ C4-63 (see Indonesia fn. 1 for origin). Imported from Philippines in 1968.

Liberia

1/ 1 ton IR-8, 1 ton IR-5, and 1 ton C4-63. Imported from Philippines in 1968.

LATIN AMERICA

Panama

1/ IR-8. Also small quantities of IR-5 and C4-113. (The latter variety was developed at the College of Agriculture at the University of the Philippines.) Imported in 1968.

Venezuela

1/ IR-8. Imported from Philippines in 1968.

REFERENCES

SOUTH ASIA

Ceylon

- (1) Randolph Barker, "Economic Aspects of High-Yielding Varieties of Rice, with Special Reference to National Price Policies," Monthly Bulletin of Agricultural Economics and Statistics, June 1969, pp. 1-2.
- (2) Letter from H. L. Dwelly, Acting AID Representative, American Embassy, Colombo, October 2, 1969 (data supplied in response to request sent to L. N. Bandaranaike, Director of Agricultural Development, Ministry of Agriculture and Food).

India

- (1) W. H. Freeman, "Rice Improvement," US-AID Agricultural Conference, New Delhi, December 5, 1967.
- (2) Barker, op. cit. (June 1969).
- (3) "Rice Crop Proves Tanjore Program's Worth," Foreign Agriculture, March 4, 1968, p. 7; Department of State Airgram A-44 from Madras, October 13, 1967.
- (4) "Rice and Wheat in India," Spring Review (AID), March 10, 1969, pp. 7, 19.
- (5) Foreign Agricultural Service Report IN-9180 from New Delhi, September 18, 1969, p. 3 (based on "Government of India Planning Commission, Annual Plan, 1969-70," p. 41).

Nepal

- (1) Department of State Telegram 6779 from New Delhi, (Reply in Telegram 80722 to New Delhi, May 29, 1969.)
- (2) Letter from Dale G. Strong, Food and Agriculture Division, AID, Kathmandu, September 12, 1969 (data from Agriculture Extension Department of Nepalese Government).

Pakistan, East

- (1) Letter from Leon F. Hesser, Assistant Director of Agricultural Policy, AID, Rawalpindi, October 9, 1969.
- (2) "Rice and Wheat in Pakistan," Spring Review (AID), March 17, 1969, pp. 2-5.

REFERENCES (cont'd)

SOUTH ASIA (cont'd)

Pakistan, East (cont'd)

- (3) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1; letter from Carl O. Winberg, Agricultural Attache, American Embassy, Rawalpindi, October 7, 1969.
- (4) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969 (official estimate by Government of Pakistan).
- (5) Barker, op. cit. (June 1969).

Pakistan, West

- (1) "Rice and Wheat in Pakistan, op. cit., pp. 16-17.
- (2) Letter from Hesser, op. cit.
- (3) Telegram TOFAS 96, op. cit.
- (4) Foreign Agricultural Service Report PK-9095 from Rawalpindi, August 5, 1969.

EAST ASIA

Burma

- (1) Barker, op. cit. (June 1969). Also see Gladys Charitz, "Rice Surplus Affirms Success," Journal of Commerce, March 29, 1968.
- (2) Data supplied by Randolph Barker, IRRI, October 2, 1969.
- (3) Official sources, August 16, 1969.
- (4) Department of State Airgram A-50 from Rangoon, March 1, 1969; Airgram A-64 from Rangoon, March 8, 1969.

Indonesia

- (1) Letter from Francis J. LeBeau, Chief, Agriculture Division, AID, Djakarta, September 30, 1969. (Data obtained from Department of Agriculture of the Government of Indonesia.)
- (2) Barker, op. cit. (June 1969).
- (3) Kampto Utomo, "Indonesia," Regional Seminar on Agriculture: Papers and Proceedings, Asian Development Bank, Manila, 1969, p. 161.



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EAST ASIA (cont'd)

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- (1) Barker, op. cit. (June 1969).
- (2) Department of State Airgram TOAID A-647 from Vientiane, August 15, 1969.
- (3) Letter from Leroy H. Rasmussen, Agriculture Division, AID, Vientiane, September 12, 1969.
- (4) Information provided by Harold Haight, Laos Desk, AID, Washington, September 10, 1969.
- (5) Department of State Airgram TOAID A-761 from Vientiane, September 23, 1969.

Malaysia

- (1) Barker, op. cit. (June 1969).
- (2) Letter from Dale K. Vining, Agricultural Attache, American Embassy, Kuala Lumpur, September 4, 1969 (estimate made by attache's office).
- (3) Foreign Agricultural Service Reports from Kuala Lumpur: AGR-40, March 2, 1964; AGR-36, January 1, 1965; AGR-7, August 19, 1966; AGR-69, September 10, 1968.

Philippines

- (1) Barker, op. cit. (June 1969)
- (2) "Rice in the Philippines," Spring Review (AID), March 3, 1969, section 2, p. 6, Appendix Table VIII-B. Data from RCPCC.
- (3) Data issued by the Bureau of Agricultural Economics, Department of Agriculture and Natural Resources, Dilman, Quezon City, January 14, 1969 (based on 1968 Crop and Livestock Survey).
- (4) Letter from Randolph Barker, IRRI, September 12, 1969.

Vietnam

- (1) "Rice in South Vietnam," Spring Review (AID), March 12, 1969 (TOAID A-1357), pp. 2, 8, 15, 16, 17.
- (2) Barker, op. cit. (June 1969).

REFERENCES (cont'd)

WEST ASIA

Iraq

- (1) Barker, op. cit. (October 1969).

AFRICA

Egypt (UAR)

- (1) Barker, op. cit. (June 1969).

Liberia

- (1) Barker, op. cit. (June 1969).

LATIN AMERICA

Panama

- (1) Barker, op. cit. (June 1969).

Venezuela

- (1) Barker, op. cit. (June 1969).

IV. SUMMARY OF AREA

MEXICAN-TYPE WHEAT

	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u> (goal)
			--- acres ---		
<u>South Asia</u>					
Afghanistan	-	4,500	65,000	300,000 1/	
India	7,400	1,278,000	7,269,000	10,000,000 1/	(10,000,000)
Nepal	3,500	16,200	61,300	133,000	
Pakistan (E)	-	-	-	20,000 1/	
Pakistan (W)	12,000	250,000	2,365,000	6,000,000 1/	
<u>West Asia</u>					
Iran	-	-	-	25,000	
Lebanon	-	-	-	1,100	(10,000)
Turkey	-	1,500	420,000	1,780,000	
<u>Africa</u>					
Morocco	-	-	500	12,100	(250,000)
Tunisia	-	-	2,000	32,000	(150,000)
Total	22,900	1,550,200	10,182,800	18,303,200 1/	

1/ Preliminary.



IRRI-TYPE RICE

	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u> (goal)
			-- acres --		
<u>South Asia</u>					
Ceylon	-	-	-	17,200	
India	13,000	2,142,000 1/	4,409,000 1/	6,500,000 1/ 2/	(8,000,000)
Nepal	-	-	-	105,000 1/	
Pakistan (E)	-	500	166,000	381,500	
Pakistan (W)	-	200 ±	10,000	761,000	(1,500,000)
<u>East Asia</u>					
Burma	-	-	7,200	470,000	(1,000,000)
Indonesia	-	-	-	416,500	
Laos	-	900	2,500	3,800	
Malaysia	-	104,500	157,000	224,700	
Philippines	-	204,100	1,733,400	2,500,000+ 2/	
Vietnam	-	-	1,200	109,000	(494,000)
Total	13,000	2,452,200	6,486,300	11,488,700 2/	

1/ All improved rice varieties.

2/ Preliminary.

ESTIMATED TOTAL AREA OF HIGH-YIELDING

VARIETIES OF WHEAT AND RICE

<u>Crop Year</u>	<u>Wheat 1/</u>	<u>Rice 2/</u>	<u>Total</u>
-- acres (rounded) --			
1965/66	23,000	13,000	36,000
1966/67	1,550,000	2,452,000	4,002,000
1967/68	10,183,000	6,486,000	16,669,000
1968/69 <u>3/</u>	18,303,000	11,489,000	29,792,000

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1/ Excluding Mexico.

2/ Excluding improved local varieties in Ceylon and Taiwan.

3/ Preliminary.

## V. APPENDIX A: ORIGIN OF VARIETIES

### Wheat

The Mexican wheat varieties discussed in this report are descendants of both Japanese and American varieties and breeding efforts.

Japan has had a long history in the development of dwarf wheat. In 1873, Horace Capron, former U. S. Commissioner of Agriculture who headed a mission to Japan, wrote that "the Japanese farmers have brought the art of dwarfing to perfection." He noted that "the wheat stalk seldom grows higher than 2 feet, and often not more than 20 inches." The head was short but heavy. The Japanese claimed that the straw had been so shortened "that no matter how much manure is used it will not grow longer, but rather the length of the wheat-head is increased." Capron noted that "on the richest soils and with the heaviest yields, the wheat-stalks never fall down and lodge." 1/

The Japanese crossed one such variety, Daruma, with a strain of the American soft red winter variety, Fultz, in 1917. The cross eventually produced a strain known as Fultz-Daruma. This strain was in turn crossed with the American hard red winter variety Turkey Red in 1924 and led to a number of different types. One of these was later known as Norin 10; it was registered and released to Japanese farmers in 1935. 2/

In 1946, Dr. S. C. Salmon, a U. S. Department of Agriculture scientist who was Agricultural Advisor to the Occupation Army in Japan, noted Norin 10 growing at a research station. The stems were short, but the heads were full sized. Dr. Salmon brought seed back to the United States in 1946. 3/

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1/ Horace Capron, "Agriculture in Japan," Report of the Commissioner of Agriculture for the Year 1873, Washington, 1874, p. 369.

2/ L. P. Reitz and S. C. Salmon, "Origin, History, and the Use of Norin 10 Wheat," Crop Science, November-December 1969 (Vol. 8, No. 6), pp. 686-689. It is not known exactly how Fultz and Turkey Red got to Japan, but Fultz arrived before 1892. Fultz was first selected in Pennsylvania in 1862 and could have been introduced by the Capron Mission during the early 1870's. Turkey Red, better known as Turkey, was introduced in Kansas in 1873 by a group of Russian Mennonites; it later became the leading U. S. variety. For details on Fultz and Turkey, see J. A. Clark et al., Classification of American Wheat Varieties, U. S. Department of Agriculture, Bulletin No. 1074, November 1922, pp. 83-85, 144-147.

3/ Reitz and Salmon, op. cit., p. 687.



Although Norin 10 was not satisfactory for direct use outside of Japan, it was useful for cross breedings. Dr. O. A. Vogel of the U. S. Department of Agriculture was the first to use it in his cooperative breedings programs at Washington State University. While this work was in progress, Dr. Norman E. Borlaug of the Rockefeller Foundation obtained some of the early crosses in 1953 for his breeding work in Mexico. These lines were crossed with Mexican, Colombian and other wheats, and a series of spring wheat varieties were produced, including Pitic 62, Penjamo 62, Sonora 63, Sonora 64, Lerma Rojo 64, and Mayo 64. 4/

#### Rice 5/

There are two main sub-species of rice, Indica and Japonica.

Indica is the traditional native variety of rice grown throughout South-east Asia, especially in the monsoon tropics. It has evolved fertility and uncertain weather. But the features that enable it to survive-- a tall stem, abundant foliage, etc.--also provide the basis for its weakness under improved agricultural practices. Improved fertilization and water supplies, for instance, will lead mainly to vegetative growth and lodging rather than a significantly increased yield.

Japonica is of more recent origin and is believed to have evolved from the Indica. It is widely grown throughout the temperate zones of the world. Its characteristics include a shorter and stiffer stalk than Indica, and less vegetative growth. It responds well to improved cultural practices--especially fertilizer--and is much more resistant to lodging. As a result, yields are considerably higher than for Indica. It is not, however, well adapted for the traditional cultural practices in southeast Asia; among other things, (1) the plants flower too early and produce little grain, and (2) grain quality is not considered fully desirable.

Attempts have been made over the course of many years to improve both types of rice for use in the tropics:

- Japonica. Research work on this variety has been conducted in Japan for more than half a century. Subsequent successes were obtained in transferring and adapting these varieties. A breeding program was initiated in Taiwan early in the century (see p. 2, fn. 6), and between 1925 and 1940 50% of the rice land in the country was shifted to Japonica varieties.

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4/ L. P. Reitz, "Short Wheats Stand Tall," 1968 Yearbook of Agriculture, pp. 236-237.

5/ This section is largely based on Randolph Barker, "The Role of the International Rice Research Institute in the Development and Dissemination of New Rice Varieties," IRRI, September 1968.

-Japonica/Indica Crosses. The FAO-India program noted in the Introduction of this bulletin (p. 1, fn. 2) was an attempt to cross Japonica and Indica varieties. Results were generally not satisfactory, though one variety --ADT-27-- did show a substantial improvement over other varieties and subsequently was widely planted in the Tanjore district.

-Indica. Attempts to improve Indica varieties were more successful. Results of this work include Taichung (Native) 1 in Taiwan, H-4 in Ceylon, BPI-76 in the Philippines and IR-8 and IR-5. IR-8 was obtained by crossing Peta, a tall Indonesian variety, with Dee-geo-woo-gen, a short Chinese variety (which is also one of the parents of TN-1). The first cross was made in 1962 and the variety was introduced in 1966. 6/ IR-5 was developed concurrently from a cross between Peta and Tangkai Rotan, a Malaysian variety (hence IR-5 does not have the same Chinese dwarf gene as IR-8 but is of moderately short height). 7/

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6/ For details, see Robert F. Chandler, "Dwarf Rice - A Giant in Tropical Asia," 1968 Yearbook of Agriculture, pp. 252-255.

7/ Further information on IR-5, including a specific comparison with IR-8, is provided in "IR-5 - A New High-Yielding IRRI Variety," The IRRI Reporter, January 1968, 4 pp.



APPENDIX B: ESTIMATED TOTAL AREA OF ALL VARIETIES 1/

	1960/61 to 1964/65 avg.	1968/69
-- acres --		
I. <u>WHEAT</u>		
<u>SOUTH ASIA</u>		
Afghanistan	NA	5,500,000
India	33,123,000	39,432,000
Nepal	330,000	371,000
Pakistan <u>2/</u>	12,301,000	14,977,000
<u>WEST ASIA</u>		
Iran	4,925,000	NA
Lebanon	142,000	151,000
Turkey	19,243,000	20,015,000
<u>AFRICA</u>		
Morocco	3,905,000	4,885,000
Tunisia	2,611,000	1,619,000
II. <u>RICE</u>		
<u>SOUTH ASIA</u>		
Ceylon	1,239,000	1,657,000
India	86,359,000	91,344,000
Nepal	2,800,000	2,766,000 <u>4/</u>
Pakistan <u>3/</u>	24,955,000	27,235,000
<u>EAST ASIA</u>		
Burma	12,000,000	12,297,000
Indonesia	17,530,000	20,950,000 <u>4/</u>
Laos	1,606,000	1,550,000 <u>4/</u>
Malaysia (West)	851,000	1,182,000
Philippines	7,821,000	7,904,000
Vietnam	6,054,000	5,528,000 <u>4/</u>

- 1/ The data listed here for all varieties are not necessarily taken from the same sources as those used for the high-yielding varieties and therefore may not be strictly comparable.
- 2/ Virtually all wheat production is in West Pakistan.
- 3/ Most of the rice area (about 85%) is in East Pakistan.
- 4/ 1967/68.

Source: World Agricultural Production and Trade, (USDA), September 1969, p. 29 (wheat), June 1969, p. 31 (rice); unpublished data provided by the Grain and Feed Division, FAS. (Afghanistan estimate from other sources.)



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